



Appendix 8: Water Resources in the Southeast Coast Network



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Water Resources

Water Bodies

Ten percent (27/262) of water resources within or adjacent to SECN Parks are 303(d)-listed waters, with one-third (9/27) of those occurring at CHAT. 303(d)-designated waters are considered to be relevant to park managers if (a) they pass through, enter or are contained within Park boundaries as EPA-designated 303(d) waters or (b) they are designated 303(d) waters upstream within the same twelve- or fourteen-digit HUC boundaries as each respective Park. Twelve-digit HUC coverages were available for AL (in draft form), FL and GA; fourteen-digit HUC coverages were available for NC and SC. All 303(d) designations are based on the most recent (2002) EPA and state listings of impaired waters and GIS coverages (<http://www.epa.gov/waters/data/downloads.html>).

Various GIS coverages [e.g., Digital Raster Graphics, National Hydrography Dataset, EPA 303(d) listed waters] and existing Park narratives were reviewed for all available information regarding documented SECN Park water bodies. Special designations of Park waters were also noted (Tables A8-1- A8-9). FOCA and WRBR have no documented water resources within Park boundaries.

Table A8-1. Water features, EPA-defined waterbody types, designations, and water-quality parameter exceeded at CAHA ^a.

Water Feature	Waterbody Type	Designation	Parameter exceeded
Albemarle Sound	Bay/Estuary	EPA and Association of National Estuary Programs (ANEP) Sponsored Estuary	
Atlantic Ocean	Coastal	303(d) ^b	Fecal coliform
Austin Creek	Bay/Estuary		
Beach Slue	Bay/Estuary		
Blackmar Gut	Bay/Estuary		
Boat Creek	Bay/Estuary		
Buxton Woods	Wetland		
Cape Creek	Bay/Estuary		
Clarks Bay	Bay/Estuary		
Cockrel Creek	Bay/Estuary		
Coff Cape Point	Bay/Estuary		
Davis Channel	Bay/Estuary		
Deamont Shoals	Bay/Estuary		
Eagle Nest Bay	Bay/Estuary		
Goat Island Bay	Bay/Estuary		
Goose Creek	Bay/Estuary		
Green Island Channel	Bay/Estuary		
Gull Island Bay	Bay/Estuary		
Hatteras Bight	Bay/Estuary	303(d) ^c	Fecal coliform
Hatteras Inlet	Bay/Estuary		
Island Creek	Bay/Estuary		
Jennette Sedge	Bay/Estuary		
Knoll Creek	Bay/Estuary		
Knoll House Creek	Bay/Estuary		
Little Swash Opening	Bay/Estuary		
Long Point Creek	Bay/Estuary		
Mary Anns Pond	Bay/Estuary		
Midgett Cove	Bay/Estuary		
No Ache Bay	Bay/Estuary		
North Bitterswash Creek	Bay/Estuary		
North Drain	Bay/Estuary		
Northern Pond	Bay/Estuary		
Ocracoke Inlet	Bay/Estuary		
Old Hammock Creek	Bay/Estuary		
Old Slough	Bay/Estuary		
Oregon Inlet	Bay/Estuary		

Water Feature	Waterbody Type	Designation	Parameter exceeded
Oregon Inlet Channel	Bay/Estuary		
Pamlico Sound	Bay/Estuary	EPA and Association of National Estuary Programs (ANEP) Sponsored Estuary	
Pauls Ditch	Bay/Estuary		
Pea Island Bay	Bay/Estuary		
Phipps Cove	Bay/Estuary		
Roanoke Sound	Bay/Estuary		
Round Hammock Bay	Bay/Estuary		
Sand Bay	Bay/Estuary		
Sand Hole Creek	Bay/Estuary		
Silver Lake	Bay/Estuary		
South Bitterswash Creek	Bay/Estuary		
Terrapin Creek Bay	Bay/Estuary		
The Drain	Bay/Estuary		
The Slash	Bay/Estuary		
The Trench	Bay/Estuary		
The Yard Creek	Bay/Estuary		
Wreck Creek	Bay/Estuary		
Unnamed Waterbody ^d	Lake/Reservoir/Pond		
Unnamed waterbody	Lake/Reservoir/Pond		
Unnamed Waterbody	Bay/Estuary	303(d) ^d	Fecal coliform

^a CAHA is designated a NOAA Marine Protected Area

^b approximately 2.5km of shoreline at southern tip of Hatteras Island, approximately 6.5km of shoreline east of Jimmys Landing

^c approximately 19km of shoreline on southern coastline of Hatteras Island

^d freshwater resources associated with reverse-osmosis plant on Ocracoke Island

^e 8 small inlets of waterbody east of Herring Shoal Island

Table A8-2. Water features, EPA-defined waterbody types, designations and water-quality parameter exceeded at CALO^a.

Water Feature	Waterbody Type	Designation	Parameter exceeded
Atlantic Ocean	Coastal	303(d) ^b	Fecal coliform
Back Sound	Bay/Estuary		
Bald Hill Bay	Bay/Estuary		
Barden Inlet	Bay/Estuary		
Baymarsh Thorofare	Bay/Estuary		
Beaufort Inlet	Bay/Estuary		
Big Marsh	Wetland		
Blinds Hammock Bay	Bay/Estuary		
Cabs Creek	Bay/Estuary		
Caggs Creek	Bay/Estuary		
Cassy Bay	Bay/Estuary		
Cedar Inlet	Bay/Estuary		
Codds Creek	Bay/Estuary		
Core Sound	Bay/Estuary		
Cross Shoal Channel	Bay/Estuary		
Daniel Swash	Bay/Estuary		
Deer Pond	Bay/Estuary		
Drum Inlet	Bay/Estuary		
Evergreen Slough	Bay/Estuary		
Fortin Bay	Bay/Estuary		
Great Island Bay	Bay/Estuary		
Great Island Creek	Bay/Estuary		
Gutter Creek	Bay/Estuary		
Head of the Hole	Bay/Estuary		
High Hills Inlet	Bay/Estuary		
Hogpen Bay	Bay/Estuary		
Horse Island Cove	Bay/Estuary		
Horse Island Creek	Bay/Estuary		
Horsepen Creek	Bay/Estuary		
Iron Creek	Bay/Estuary		
Johnson Bay	Bay/Estuary		
Johnson Creek	Bay/Estuary		
Lewis Creek	Bay/Estuary		
Lighthouse Bay	Bay/Estuary		
Lighthouse Channel	Bay/Estuary		
Lookout Bight	Bay/Estuary	303(d) ^c	Fecal coliform
Mullet Cove	Bay/Estuary		
Mullet Pond	Bay/Estuary		

Water Feature	Waterbody Type	Designation	Parameter exceeded
Negro Creek	Bay/Estuary		
Ocrakoke Sound	Bay/Estuary		
Old Channel	Bay/Estuary		
Onslow Bay	Bay/Estuary	303(d) ^d	Fecal coliform
Pamlico Sound	Bay/Estuary	EPA and Association of National Estuary Programs (ANEP) Sponsored Estuary	
Point of Grass Creek	Bay/Estuary		
Rawson Creek	Bay/Estuary		
Royal Point Bay	Bay/Estuary		
Sand Island Inlet	Bay/Estuary		
Shackleford Slue	Bay/Estuary		
Sheep Island Slue	Bay/Estuary		
Sheep Pen Creek	Bay/Estuary		
Swash Inlet	Bay/Estuary		
The Ditch	Bay/Estuary		
The Haulover	Bay/Estuary		
The Swash	Bay/Estuary		
Try Yard Creek	Bay/Estuary		
Whale Creek	Bay/Estuary		
Yaupon Hammock Gut	Bay/Estuary		
Zack Creek	Bay/Estuary		

^a CALO is designated a NOAA Marine Protected Area

^b approximately 27.5km of eastern shoreline of Core Banks

^c approximately 2.2km of shoreline of Lookout Bight east of Wreck Point

^d approximately 2.0km of shoreline of Onslow Bay at Cape Lookout

Table A8-3. Water features, EPA-defined waterbody types, designations and water-quality parameter exceeded at CANA^a.

Water Feature	Waterbody Type	Designation	Parameter exceeded
Atlantic Ocean	Coastal		
Bissitte Bay	Bay/Estuary		
Bittersweet Cove	Bay/Estuary		
Blue Hole	Bay/Estuary		
Brickhouse Cove	Bay/Estuary		
Cucumber Slough	Bay/Estuary		
East Channel	Bay/Estuary		
East Max Hoeck Creek	Bay/Estuary		
Eddy Creek	Bay/Estuary		
Gaines Slough	Bay/Estuary		
Gallinipper Basin	Bay/Estuary		
Georges Slough	Bay/Estuary		
Glory Hole	Bay/Estuary		
Max Hoeck Back Creek	Bay/Estuary		
Max Hoeck Creek	Bay/Estuary		
Mosquito Lagoon ^b	Bay/Estuary	EPA - Estuary of National Significance, 303(d) ^c	Total coliform
Orange Island Creek	Bay/Estuary		
Pardon Slough	Bay/Estuary		
Slippery Creek	Bay/Estuary		
Turner Flats	Bay/Estuary		
Vanns Slough	Bay/Estuary		
Widgeon Bay	Bay/Estuary		

^a **CANA is designated a NOAA Marine Protected Area**

^b **includes all listed Park water features, except Atlantic Ocean**

^c **approximately 8.3km of NW Park boundary**

Table A8-4. Water features, EPA-defined waterbody types, designations and water-quality parameter exceeded at CHAT^a.

Water Feature	Waterbody Type	Designation	Parameter exceeded
Big Creek	Stream/Creek/River	303(d)	Fecal coliform
Chattahoochee River	Stream/Creek/River	303(d)	Mercury, PCBs
Crooked Creek	Stream/Creek/River	303(d)	Fecal coliform
Haw Creek	Stream/Creek/River		
James Creek	Stream/Creek/River		
Long Island Creek	Stream/Creek/River	303(d)	Fecal coliform
Morgan Falls Reservoir	Lake/Reservoir/Pond	303(d)	Mercury, PCBs
Peachtree Creek	Stream/Creek/River	303(d)	Fecal coliform
Richland Creek	Stream/Creek/River		
Rottenwood Creek	Stream/Creek/River	303(d)	Fecal coliform
Sope Creek	Stream/Creek/River	303(d)	Fecal coliform
Suwanee Creek	Stream/Creek/River	303(d)	Fecal coliform

^a Five additional 303(d)-listed Stream/Creek/Rivers drain into the Chattahoochee River within Park boundaries, but were not considered significant Park water resources (March Creek, Willeo Creek, Hog Wallow Creek, Ball Mill Creek, Johns Creek); all exceed established Fecal coliform levels

Table A8-5. Water features, EPA-defined waterbody types and designations at CONG.

Water Feature	Waterbody Type	Designation
Bates Old River	Lake / Reservoir/Pond	
Big Lake	Lake/Reservoir/Pond	
Cedar Creek	Stream/Creek/River	
Congaree River	Stream/Creek/River	
Congaree River Dry Branch	Stream/Creek/River	
Fork Swamp	Wetland	
Griffins Creek	Stream/Creek/River	
Old Dead River	Stream/Creek/River	
Running Lake	Lake/Reservoir/Pond	
Singleton Creek	Stream/Creek/River	
Toms Creek	Stream/Creek/River	
Weston Lake	Lake/Reservoir/Pond	
Wise Lake	Lake/Reservoir/Pond	

Table A8-6. Water features, EPA-defined waterbody types, designations and water-quality parameter exceeded at CUIS
^a.

Water Feature	Waterbody Type	Designation	Parameter exceeded
Ashley pond	Lake/Reservoir/Pond		
Atlantic Ocean	Coastal		
Beach Creek	Bay/Estuary		
Brickhill River	Bay/Estuary	303(d)	Shellfishing ban ^b
Brockington Creek	Bay/Estuary		
Christmas Creek	Bay/Estuary		
Crooked River	Bay/Estuary		
Cumberland River	Bay/Estuary	303(d)	Shellfishing ban ^b
Cumberland Sound	Bay/Estuary		
Hawkins Creek	Bay/Estuary		
Johnson Pond	Wetland		
Lake Retta	Lake/Reservoir/Pond		
Mallkintooh Creek	Bay/Estuary	303(d)	Shellfishing ban ^b
McCall Pond	Wetland		
Mud Creek	Bay/Estuary	303(d)	Shellfishing ban ^b
Mumford Creek	Bay/Estuary		
Oldhouse Creek	Stream/Creek/River	303(d)	Shellfishing ban ^b
Saint Andrew Sound	Bay/Estuary		
Saint Marys Entrance	Bay/Estuary		
Shell Creek	Bay/Estuary		
South End Ponds	Lake/Reservoir/Pond		
Sweetwater Lakes Complex	Lake/Reservoir/Pond		
White Branch	Lake/Reservoir/Pond		
Whitney Lake	Lake/Reservoir/Pond		
Willow Pond	Wetland		

^a CUIS is designated a NOAA Marine Protected Area

^b Unknown parameters violated

Table A8-7. Water features, EPA-defined waterbody types, designations and water-quality parameter exceeded at FOPU.

Water Feature	Waterbody Type	Designation	Parameter exceeded
Bull River	Bay/Estuary		
Lazaretto Creek	Bay/Estuary		
The Moat	Artificial Canal		
Oyster Creek	Bay/Estuary		
Savannah River	Bay/Estuary	303(d)	Mercury
South Channel	Bay/Estuary		
Unnamed Waterbody (n=2)	Lake/Reservoir/Pond		

Table A8-8. Water features, EPA-defined waterbody types, designations and water-quality parameter exceeded at TIMU^{abc}.

Water Feature	Waterbody Type	Designation	Parameter exceeded
Atlantic Ocean	Coastal		
Back River	Bay/Estuary		
Bogey Branch	Bay/Estuary		
Broward Creek	Bay/Estuary		
Browns Creek	Bay/Estuary		
Buckhorn Creek	Bay/Estuary		
Burton Creek	Bay/Estuary		
Cabbage Hammock Swamp	Bay/Estuary		
Cedar Point Creek	Bay/Estuary		
Chicopit Bay	Bay/Estuary		
Clapboard Creek	Bay/Estuary		
Colorinda Creek	Bay/Estuary		
Deep Creek	Bay/Estuary		
Deese Creek	Bay/Estuary		
Edwards Creek	Bay/Estuary		
Fitzpatrick Creek	Bay/Estuary		
Fort George Inlet	Bay/Estuary		
Fort George River	Bay/Estuary		
Garden Creek	Bay/Estuary		
Grandaddy Branch	Bay/Estuary		
Greys Swamp	Bay/Estuary		
Gunnison Cut	Bay/Estuary		
Hannah Mills Creek	Bay/Estuary		
Haulover Creek	Bay/Estuary		

Water Feature	Waterbody Type	Designation	Parameter exceeded
Horseshoe Creek	Bay/Estuary		
Inconstantion Creek	Bay/Estuary		
Lake Timucuan	Lake/Reservoir/Pond		
Mesa Marsh	Bay/Estuary		
Mill Branch	Bay/Estuary		
Mink Creek	Bay/Estuary		
Mount Pleasant Creek	Bay/Estuary		
Mud Flats	Bay/Estuary		
Mud River	Bay/Estuary		
Myrtle Creek	Bay/Estuary		
Nassau River	Stream/Creek/River	303(d)	Total coliform, Turbidity
Nassau Sound	Bay/Estuary		
Pablo Creek	Bay/Estuary		
Pumpkin Hill Creek	Bay/Estuary		
Round Pond	Bay/Estuary		
Saint Johns Creek	Bay/Estuary		
Saint Johns River	Stream/Creek/River	EPA - American Heritage River, 303(d)	Total coliform, Turbidity, Total suspended solids
Samples Creek	Bay/Estuary		
Sawpit Creek	Bay/Estuary		
Seaton Creek	Bay/Estuary		
Sherman Creek	Bay/Estuary		
Simpson Creek	Bay/Estuary		
Sisters Creek	Bay/Estuary		
Spanish Pond	Lake/Reservoir/Pond		
Starrett Creek	Bay/Estuary		
Thomas Creek	Bay/Estuary		

^a TIMU is designated a NOAA Marine Protected Area

^b TIMU is designated Outstanding Florida Waters by Florida Department of Environmental Protection

^c Approximately 15% of TIMU is in the St. Johns – Nassau River State Aquatic Preserve.

Table A8-9. Water features, EPA-defined waterbody types, designations and water-quality parameter exceeded for CASA, CHPI, FOFR, FOMA, FORA, FOSU, HOBE, KEMO, MOCR and OCMU.

Park	Water Feature	Waterbody Type	Designation	Parameter exceeded
CASA	Matanzas River	Bay/Estuary		
CASA	San Sebastian River	Bay/Estuary		
CHPI	Horlbeck creek	Stream/Creek/River		
FOFR	Frederica River	Bay/Estuary		
FOMA	Atlantic Ocean	Coastal		
FOMA	Matanzas Inlet	Bay/Estuary		
FOMA	Matanzas River	Bay/Estuary		
FORA	Albemarle Sound	Bay/Estuary		
FORA	Dough Point	Bay/Estuary		
FORA	Roanoke Sound	Bay/Estuary		
FOSU	Atlantic Ocean	Coastal		
FOSU	Charleston Harbor	Bay/Estuary		
FOSU	Cooper River	Bay/Estuary		
FOSU	The Cove	Bay/Estuary		
HOBE	Tallapoosa River	Stream/Creek/River		
KEMO	Allatoona Creek	Stream/Creek/River		
KEMO	Noses Creek	Stream/Creek/River		
KEMO	Ward Creek	Stream/Creek/River	303(d)	Lead
MOCR	Moore's Creek	Stream/Creek/River		
OCMU	Ocmulgee River	Stream/Creek/River	303(d)	Fecal coliform
OCMU	Walnut Creek	Stream/Creek/River	303(d)	Biological

^a FOMA included in NOAA National Estuarine Research Reserve System

Water Quality

Despite the Federal Water Pollution Control Act of 1956, subsequent amendments in 1972, the Federal Water Pollution Control Act of 1972, the Clean Water Act of 1977 and the Safe Drinking Water Act of 1977, the chemical, biological and physical integrity of the nation's waters remains threatened (Hermann et al. 1998). Compromised water quality is largely the result of poor management of chemical, biological and physical discharge/waste from urbanization/population growth and agricultural and industrial activities. Adverse effects of impeded water quality on biota include altered floral- and faunal- species composition, reduced fecundity, low fitness, and bioaccumulation. The Southeastern U.S. is one of the fastest growing areas in the nation; consequently, marine and freshwater water quality throughout Southeast Region Parks has been impacted (White et al. 1998). Despite the abundance of 303(d)-listed waters in the Southeast Region, only ten percent of SECN water resources are 303(d) listed (Figure A8-1) (Tables A8-1 – A8-9). However, most of the SECN parks are downstream from multiple 303(d) listed waters outside NPS jurisdiction (Figure A8-1).

Water quality data in most SECN Parks, and adjacent lands, have been collected by a variety of governmental and private entities. Existing data were compiled and summarized by the Inventory and Monitoring Program and Water Resources Division of the USDI National Park Service (NPS) and Horizon Systems Corporation (HSC) into documents referred to as the Horizon Reports (National Park Service 1994a, National Park Service 1994b, National Park Service 1994c, National Park Service 1994d, National Park Service 1994e, National Park Service 1994f, National Park Service 1997, National Park Service 1998a, National Park Service 1998b, National Park Service 2001, National Park Service 2002a, National Park Service 2002b). Although the Horizon Reports provide a very

thorough summary of baseline water quality data in SECN Parks, the data compiled and summarized for this endeavor included data only as recent as 1990 and 1992 for FOFR and CAHA, respectively, or 1998 for FOMA, FOPU, FOSU and TIMU (Table A8-10). As a result, recent trends in water quality are unknown. The SECN Inventory and Monitoring team is currently acquiring these data to establish recent trends in water quality at SECN Parks.

Thoroughness of water quality data varies from park to park. However, data are adequate to establish trends in waterbodies adjacent to parks, and infer status in parks if data within park boundaries are limited. Nonetheless, gaps in the datasets, in terms of evaluations of all significant water resources in each Park, do exist (e.g., no water-quality sampling has occurred on two freshwater ponds at FOPU that account for 67% of freshwater resources at the Park) and attempts to rectify these issues will be incorporated into future water-quality sampling design. Because many agencies, organizations and individuals have contributed to existing long-term water-quality data (in regard to data collection and laboratory analyses), estimates of data accuracy, precision, and subsequent reliability, are currently unknown.

Results from the Horizon reports were qualitatively summarized in order to determine potential “red flags”, or parameters that consistently exceed established water quality criteria, in SECN park water resources and assist in determining focal points (i.e., water-quality parameters) for future water-quality sampling design (Table A8-11). Total Coliform (TC) measurements commonly exceeded EPA standards in SECN parks, although Fecal Coliform was not consistently differentiated from TC, and several forms of TC are naturally occurring. High levels of Coliform (Fecal and Total) continue to be an issue, as 63% (17/27) of 2002 303(d)-listed waters in SECN Parks had Coliform levels in excess of EPA standards (Tables A8-1 – A8-9). Although no other “red flags” are evident in existing Network-wide data, Chloride and Copper levels exceeded EPA standards in several Parks. CHAT appears to have the most “red flags” of any SECN Park, and exceeds Georgia and EPA standards for Turbidity, Total Dissolved Solids, Fecal Coliform, Copper, Lead, Mercury, Zinc, PCBs and Chlordane (Table A8-11) (Kunkle and Vana-Miller 2000). Current EPA guidelines for select water quality parameters are also presented (Tables A8-12 – A8-14).

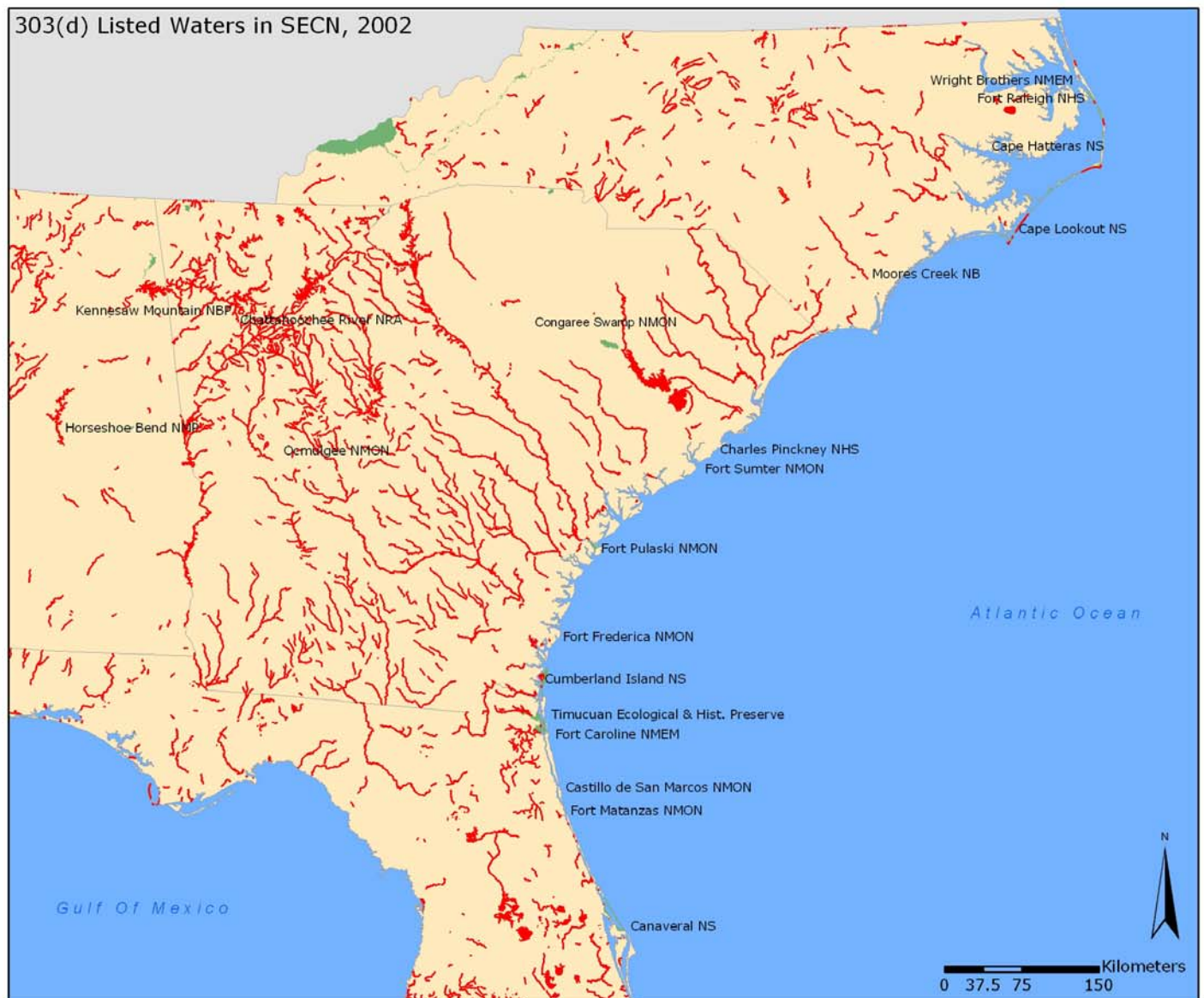
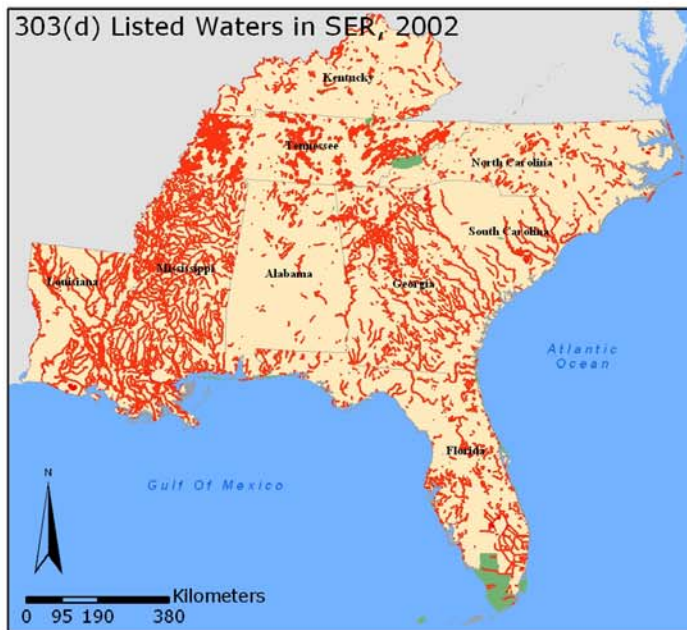


Figure A8-1. 303(d) waters in SER and SECN, 2002.

Table A8-10. Years water quality data summarized for baseline estimates in SECN parks and immediately adjacent areas (National Park Service 1994a, National Park Service 1994b, National Park Service 1994c, National Park Service 1994d, National Park Service 1994e, National Park Service 1994f, National Park Service 1997, National Park Service 1998a, National Park Service 1998b, National Park Service 2001, National Park Service 2002a, National Park Service 2002b).

Park	Years Data Summarized
CAHA	1968-1992
CANA	1956-1995
CALO	1966-1994
CASA / FOMA	1973-1997 / 1971-1998
CHAT	n/a
CONG	1957-1997
CUIS	1965-1993
FOFR	1967-1990
FOPU	1960-1998
FOSU / CHPI	1955-1998
HOBE	1962-1997
KEMO	1976-1997
MOCR	1973-1997
OCMU	1937-1998
TIMU / FOCA	1961-1998

Table A8-11. Baseline water quality summary for SECN Parks and immediately adjacent areas ("–", Not detected or unknown occurrence; ○, Recorded occurrence; ●, Potential Red Flag) (National Park Service 1994a, National Park Service 1994b, National Park Service 1994c, National Park Service 1994d, National Park Service 1994e, National Park Service 1994f, National Park Service 1997, National Park Service 1998a, National Park Service 1998b, Kunkle and Vana-Miller 2000, National Park Service 2001, National Park Service 2002a, National Park Service 2002b).

Parameter	CAHA	CANA	CALO	CASA/ FOMA	CHAT	CONG	CUIS	FOFR	FOPU	FOSU / CHPI ^j	HOBE	KEMO	MOCR	OCMU	TIMU / FOCA
General															
Dissolved Oxygen	-	○	-	○	○	○	○	-	●	○	○	○	○	-	○
Specific Conductance	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-
Water Temperature	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-
Air Temperature	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Flow	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-
Turbidity	-	○	-	○	●	○	○	-	○	○	○	-	○	○	○
Total Dissolved Solids	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-
pH	○ ^a	-	○ ^d	○	-	●	○	-	○ ^h	○	●	●	●	○	○
Biological															
Total Coliform and Fecal Coliform	● ^b	● ^c	●	●	●	●	● ^g	-	●	●	●	●	○ ^j	●	●
Index of Biological Integrity (IBI) (Karr et al. 1986)	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-
Invertebrate Community Index (ICI) (Ohio EPA 1987a, Ohio EPA 1987b, Ohio EPA 1989a, Ohio EPA 1989b, Ohio EPA 1990)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Estuarine Invertebrate Indices (U.S.Environmental Protection Agency 1993, Engle et al. 1994, U.S.Environmental Protection Agency 1994a, U.S.Environmental Protection Agency 1994b)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rapid Bioassessment Protocols (RBP) (Plafkin et al. 1989)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biological Oxygen Demand (BOD)	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-
Nutrients															
Nitrite plus Nitrate	-	-	-	-	○	○	-	-	-	-	-	-	-	-	-
Total Nitrogen	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-
Phosphorus	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-
Chlorophyll a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals															
Antimony	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	-	-	-	● ^e	-	-	-	-	-	-	-	-	-	-	○
Beryllium	-	-	-	-	-	●	-	-	-	-	-	-	-	-	-
Metals (cont.)															
Cadmium	○	-	○	○	-	○	-	-	-	○	-	○	-	-	○

Parameter	CAHA	CANA	CALO	CASA/ FOMA	CHAT	CONG	CUIS	FOFR	FOPU	FOSU / CHPI ⁱ	HOBE	KEMO	MOCR	OCMU	TIMU / FOCA
Chromium	-	-	-	-	-	○	-	-	○	○	-	○	-	-	○
Copper	●	○	●	●	●	○	-	●	-	○	-	○	○	○	●
Iron	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	○	-	●	○	●	○	-	-	○	●	-	●	○	○	○
Mercury	○	-	○	-	●	○	-	-	-	○	-	-	-	-	○
Nickel	●	○	○	○ ^e	-	○	-	-	-	○	-	-	-	-	○
Selenium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	-	●	-	○ ^e	-	-	○	-	-	○	-	-	-	-	●
Thallium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	○	○	○	●	●	○	-	-	-	○	-	○	○	○	○
Organics															
Indeno (1,2,3-cd) pyrene	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-
Methylene Chloride (Dichloromethane)	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-
Hydrogen Sulfide	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethylene	-	-	-	-	-	-	-	-	-	-	-	○	-	-	-
Tributyltin (TBT)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inorganics															
Chloride	-	●	-	●	-	○ ^f	●	-	-	●	-	○ ^f	-	○ ^f	●
Chlorine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-
Fluoride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○
Polychlorinated Biphenyls (PCBs)	-	○	-	-	●	-	-	-	-	-	-	-	-	-	-
Sulfate	-	-	-	●	-	-	●	-	●	○	-	-	-	-	●
Toxaphene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pesticides															
4,4'-DDT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aldrin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
alpha-Endosulfan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
beta-Endosulfan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlordane	-	-	-	-	●	-	-	-	-	-	-	-	-	-	-
Chloropyrifos	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-
Pesticides (cont.)															
Demeton	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dieldrin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Parameter	CAHA	CANA	CALO	CASA/ FOMA	CHAT	CONG	CUIS	FOFR	FOPU	FOSU / CHPI ⁱ	HOBE	KEMO	MOCR	OCMU	TIMU / FOCA
Endrin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
gamma-BHC (Lindane)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Guthion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor Epoxide	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Malathion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methoxychlor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mirex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parathion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pentachlorophenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

^a 8/311 observations exceeded Criterion Continuous Concentration (CCC)

^b primarily in Pamlico Sound, Roanoke Sound and Shallow Bag Bay

^c primarily in Indian River Lagoon

^d 32/475 observations exceeded Criterion Continuous Concentration (CCC)

^e only detected at CASA

^f total residual chlorine

^g primarily in Amelia River

^h 599/4685 observations exceeded Criterion Continuous Concentration (CCC)

ⁱ results for FOSU only, no water resources at CHPI

^j only one year of data collected

Table A8-12. U.S. Environmental Protection Agency water quality guidelines for general water attributes and fecal coliform (U.S.Environmental Protection Agency 1986, U.S.Environmental Protection Agency 2002, U.S.Environmental Protection Agency 2003).

Parameter	Aquatic	Marine
Dissolved Oxygen (mg/L)	6.5 ^a ; 5.5 ^b	5.0
Specific Conductance	c	c
Water Temperature	d	d
Air Temperature	e	e
Depth	e	e
Flow	e	e
Turbidity (FTU) ^f	5.7 ^{gh} , 1.9 ^{ij} , 3.04 ^{kh}	c
pH	6.5-9 ^l	6.5-8.5 ^l
Fecal Coliform ^m	200	100 ^{nop} ; 200 ^{qr}

^a cold water

^b warm water

^c variable, state-specific

^d variable, species-specific

^e variable, no specific requirements

^f (U.S.Environmental Protection Agency 2000a, U.S.Environmental Protection Agency 2000b, U.S.Environmental Protection Agency 2000c)

^g EPA Ecoregion IX [SECN Parks in EPA Ecoregion IX (Southeastern Temperate Forested Plains and Hills) – CHAT, CONG, HOBE, KEMO, OCMU]

^h FTU

ⁱ EPA Ecoregion XII [SECN Parks in EPA Ecoregion XII (Southern Coastal Plain) – CANA, CASA, CUIS, FOCA, FOFR, FOMA, FOPU, TIMU]

^j NTU

^k EPA Ecoregion XIV [SECN Parks in EPA Ecoregion XIV (Eastern Coastal Plain) – CAHA, CALO, CHPI, FORA, FOSU, MOCR, WRBR]

^l Criterion Continuous Concentration

^m geometric mean (Most Probable Number - MPN) of Fecal Coliform Units per 100 ml, FCU/100ml

ⁿ Alabama

^o Florida

^p Georgia

^q North Carolina

^r South Carolina

Table A8-13. U.S. Environmental Protection Agency water quality guidelines for nutrient parameters (U.S.Environmental Protection Agency 2000a, U.S.Environmental Protection Agency 2000b, U.S.Environmental Protection Agency 2000c, U.S.Environmental Protection Agency 2000d, U.S.Environmental Protection Agency 2000e, U.S.Environmental Protection Agency 2000f).

EPA Ecoregion	Reference Condition (25 th percentiles)					
	Lakes/ponds			Rivers/streams		
	IX ^a	XII ^b	XIV ^c	IX ^a	XII ^b	XIV ^c
Parameter						
Total Nitrogen (mg/L)	0.36	0.52	0.32	0.69	0.9	0.71
Total Phosphorus (µg/L)	20.0	10.0	8.0	36.56	40.0	31.25
Chlorophyll <i>a</i> (µg/L)	4.93 ^d	2.6 ^e	2.9 ^d	0.93 ^e	0.40 ^e	3.75 ^e

^a SECN Parks in EPA Ecoregion IX (Southeastern Temperate Forested Plains and Hills) – CHAT, CONG, HOBE, KEMO, OCMU

^b SECN Parks in EPA Ecoregion XII (Southern Coastal Plain) – CANA, CASA, CUIS, FOCA, FOFR, FOMA, FOPU, TIMU

^c SECN Parks in EPA Ecoregion XIV (Eastern Coastal Plain) – CAHA, CALO, CHPI, FORA, FOSU, MOCR, WRBR

^d Fluorometric method

^e Spectrophotometric method

Table A8-14. U.S. Environmental Protection Agency water quality guidelines for trace element and organic parameters (U.S.Environmental Protection Agency 1986, U.S.Environmental Protection Agency 2002).

Parameter	Freshwater		Saltwater	
	CMC	CCC	CMC	CCC
	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Metals				
Antimony	9000.0	1600.0	ne ^a	ne
Arsenic	340.0	150.0	69.0	36.0
Beryllium	130.0	5.3	ne	ne
Cadmium	2.0	0.25	40.0	8.8
Chromium (III)	570.0	74.0	ne	ne
Chromium (IV)	16.0	11.0	1100.0	50.0
Copper	13.0	9.0	4.8	3.1
Iron	ne	1000	ne	300
Lead	65.0	2.5	210.0	8.1
Mercury	1.4	0.77	1.8	0.94
Nickel	470.0	52.0	74.0	8.2
Selenium	ne	5.0	290	71
Silver	3.2	ne	1.9	ne
Thallium	1400.0	40.0	2130.0	ne
Zinc	120.0	120.0	90.0	81.0
Organics				
Indeno (1,2,3-cd) pyrene	ne	ne	ne	ne
Methylene Chloride	ne	ne	ne	ne
Hydrogen Sulfide	ne	2.0	ne	2.0
Tetrachloroethylene	ne	ne	ne	ne
Tributyltin (TBT)	0.46	0.063	0.37	0.010
Inorganics				
Chloride	860000.0	230000.0	ne	ne
Chlorine	19.0	11.0	13.0	7.5
Cyanide	22.0	5.2	1.0	1.0
Fluoride	ne	2.0	ne	ne
Polychlorinated Biphenyls (PCBs)	ne	0.014	ne	0.03
Sulfate	ne	250.0	ne	ne
Toxaphene	0.73	0.0002	0.21	0.0002
Pesticides				
4,4'-DDT	1.1	0.001	0.13	0.001
Aldrin	3.0	ne	3.0	ne
alpha-Endosulfan	0.22	0.056	0.034	0.0087
beta-Endosulfan	0.22	0.056	0.034	0.0087

Parameter	Freshwater		Saltwater	
	CMC	CCC	CMC	CCC
	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Pesticides (cont.)				
Chlordane	2.4	0.0043	0.09	0.004
Chloropyrifos	0.083	0.041	0.011	0.0056
Demeton	0.1	ne	0.1	ne
Dieldrin	0.24	0.056	0.71	0.0019
Endrin	0.086	0.036	0.037	0.0023
gamma-BHC (Lindane)	0.95	ne	0.16	ne
Guthion	ne	0.01	ne	0.01
Heptachlor	0.52	0.0038	0.053	0.0036
Heptachlor Epoxide	0.52	0.0038	0.053	0.0036
Malathion	ne	0.1	0.1	ne
Methoxychlor	ne	0.03	ne	0.03
Mirex	ne	0.001	ne	0.001
Parathion	0.065	0.013	ne	ne
Pentachlorophenol	19.0	15.0	13.0	7.9

^a none established

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